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New cell design and anhydrous cell-feed for magnesium save energy and reduce production cost

New modular cell design and a new processing step to produce a completely anhydrous cell-feed—improvements to researches at the Central Electrochemical Research Institute (CECRI), Karaikudi—are not only likely to reduce the cost of production of electrolytic magnesium, but, equally significantly, effect savings in electrical power consumption.

In spite of its being 30% lighter in weight than aluminium, magnesium is unable to compete at present with aluminium in many structural uses, only because of its high cost. The present magnesium-to-aluminium cost ratio is 1.0. If this ratio could be brought down to 1.2:1.0, magnesium can, with many advantages, replace aluminium in structural industries and other applications. With the world reserves of aluminium dwindling and raw materials of magnesium still in abundance, efforts are called for in this direction. Efforts are therefore being made worldwide to effect energy savings in magnesium metal production. The two areas where scope exists for energy saving are (i) reduction of energy consumption in the electrolytic cells, and (ii) improvement in the quality of cell-feed to obtain better operational efficiencies.

Conventional electrolytic cells which are being operated in all parts of the world work at 6 to 7 V with a specific energy consumption of 22.23 kWh/kg vs 14-15 kWh/kg required for aluminium metal production. CECRI had also been operating a cell of its own design which worked at 7 V. The newly developed

CECRI modular design cell operates at 4 to 5 V, thus reducing the specific energy consumption to 14-15 kWh/kg. A 8 kA pilot cell based on the new design has been successfully worked. A feature of this design is that the size of the cell is also considerably reduced, saving about 30% floor space. Another advantage of the new design is that its modular construction enables fabrication of very high capacity cells of the order of 30 to 60 kA by employing a plurality of 2.5 to 3 kA modules the prototypes of which have been tried on pilot scale.

Owing to the complications and expensive processing steps involved in converting magnesium chloride solutions to a completely anhydrous magnesium chloride, which is the preferred cell-feed, it had become a common practice with several manufacturers to feed only a partially dehydrated magnesium chloride in the electrolytic cells. This resulted in the consumption of graphite electrodes to the tune of 10% of the metal produced, besides reducing cell efficiencies. However, till now it was felt that the overall costs resulting from high graphite consumption and low efficiencies would be lower than the costs of processing to get a completely dehydrated cell-feed. The CECRI's inexpensive processing step yields a completely dehydrated magnesium chloride from the partially dehydrated MgCl_2 1 to 1.5 H_2O obtained by spray drying. The process consists in briquetting the spray-dried MgCl_2 1 to 1.5 H_2O with some carbon and drying it in a current of chlorine gas obtained from

the electrolytic cell under controlled conditions. Thus the magnesium chloride content of the spray-dried material is increased from 76 to 95% with no moisture in the end product. With such a product the electrolytic cells could operate at 80 to 90% current efficiency vs 70 to 75% obtained in the present practice, with practically no consumption of graphite electrode.

Thus the two new developments are likely to bring down the production cost of magnesium metal to a significant extent, enabling magnesium to compete with aluminium as a structural material.

The Tamilnadu Industrial Development Corporation—CECRI's licensee for the process—have decided to adopt the new cell and its feed in their proposed 600 tonnes per annum commercial plant to be set up in the public sector. □

NPL scientists take a fresh look at superconductivity theory

The generally accepted theory of the phenomenon of superconductivity—the state in which a material exhibits zero electrical resistance and hence infinite conductivity—is that advanced by the 1972 Nobel Prizewinners John Bardeen, Leon Cooper and Robert Schrieffer. In

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this theory, known after them as the BCS theory, superconductivity is explained as due to the pairing of electrons of opposite spins and momenta taking place as a result of phonons—the vibrations of the crystal lattice. This theory of superconductivity appears no longer tenable in the light of new experimental evidence adduced by the National Physical Laboratory (NPL), New Delhi. The NPL's researchers—Dr S.N. Ekbote, Dr S.K. Gupta and Dr A.V. Narlikar have therefore put forth a more plausible mechanism of superconductivity in which the phenomenon is explained as due to the magnetic ordering of conduction electrons, which in turn explains many of the properties which BCS theory fails to do. For instance, a superconductor's microscopic magnetic properties are better explained by the new mechanism than by BCS theory. The latter also failed not only in predicting new superconductors, it was also unsatisfactory in accounting for the observed transition temperatures of known superconductors. Thus, the phonon mechanism, the mainstay of the BCS theory, appears to be based on unproven assumptions. The new mechanism put forth by the NPL team is the outcome of their study on a variety of superconductors, such as A-15 (Nb_3Ge , Nb_3Sn , Nb_3Si , etc.), Chevral phases (PbMo_6S_8 , InMo_6S_8 , etc.), and pure metals like Re. Using for the first time in this field a technique called conduction electron spin resonance (CESR), the NPL researchers have made a comparative study of superconductivity and magnetic properties in relation to electronic configuration of solids. Their experimental findings show that CESR absorption observed in the normal state disappears completely in the superconducting state. The vanishing of CESR in the superconducting state is a striking observation which is in contradiction to the BCS type of pairing, i.e. phonon-induced pairing of electrons. On the basis of a critical analysis of the data, the NPL scientists have suggested that electrons undergo-

ing pairing transition are bound through exchange interactions, leading to an ordered antiferromagnetic state in the conduction band. In other words, exchange interactions of antiferromagnetic type present in the conduction band are responsible for superconductivity.

The critical analysis done by the NPL researchers of the unexplained magnetic behaviour of aluminium and ternary compounds like YRh_4B_4 , studied elsewhere, reinforces the new mechanism that superconductivity is an ordered magnetic state in the conduction band resulting from exchange interactions. □

NAL's Probes for Measuring Aerodynamic Parameters

The success of an aircraft accomplishing its operational mission depends greatly upon the accuracy with which certain aerodynamic parameters of the air mass through which the aircraft is flying can be measured. The National Aeronautical Laboratory (NAL), Bangalore, has developed an angle of attack sensor and a total air temperature probe, which form vital inputs to an air data computer in an aircraft and thus contribute significantly to the success of an aircraft's operational mission.

Angle of Attack Sensor

The sensor is used to measure the angle between the fore-aft axis of an aircraft and the wind stream during flight. It consists of a cylindrical probe having two rows of orifices at an angular separation of 90° . These two rows of orifices are connected to an extremely sensitive differential pressure transducer. The sensor automatically rotates the probe until the differential pressure between the two rows of orifices is zero, thus ensuring that the two rows are symmetrically oriented with respect to the air stream direction. If the probe is not precisely oriented to the air stream direction, an electrical error signal from the differential pressure transducer is amplified by a power amplifier and applied to a two-phase servomotor

which in turn applies a powerful torque to the probe, reorienting it in the direction of the air stream. The axis through which the probe rotates gives the angle of attack. The differential pressure transducer, which forms the heart of the instrument, is a variable reluctance pickup employing a membrane bonded silicone rubber membrane as a sensing element.

Total Air Temperature Probe

This probe is used to obtain the static air temperature outside an aircraft during flight. The measurement of static air temperature is essential for true air speed measurements and determination of other jet engine control parameters.

The probe consists of a miniature platinum resistance element having a very fast response. This is mounted centrally between two concentric radiation shields having a definite inlet-to-outlet ratio. This cylindrical arrangement is mounted parallel to the free stream flow outside the boundary layer of the aircraft.

The air entering the space between the sensor and the shields is decelerated and compressed adiabatically. The resistance element thus measures the sum of the static air temperature and the temperature rise due to compression, i.e. the total air temperature. The static air temperature is computed from this by an air data computer knowing the Mach number and the probe constants.

A self-balancing-cum-linearizing bridge network operating in a closed servoloop is utilized to sense the variation in resistance in order to obtain the electrical equivalent of the temperature.

NAL designs rig for determining afterbody drag

The need for developing capability to determine afterbody drag for a given aircraft configuration as well as to undertake component studies for reducing this contribution to the aircraft drag has been widely recognized. The importance of the afterbody drag is on account of adverse effects on aircraft performance and on fuel consumption.

an effort towards this end, the National Aeronautical Laboratory (NAL), Bangalore, has designed and built an afterbody rig for use in its wind tunnel in subsonic, transonic and supersonic ranges. It is designed for force and pressure measurements in the presence of a jet. The emphasis has been on interchangeability for symmetric configuration and more complex shapes that may be required, say, twin-engine aircraft configuration. Force isolation of the metric afterbody from the non-metric forebody is achieved by stainless steel bellows and teflon rings. The rig was successfully tested in NAL's 0.9 m low-speed wind tunnel in wind and jet-on condition. □

Computer Handling of Sparse Matrices

Solving a large set of equations is one of the most important problems in science and engineering. Such problems generally lead to very large sparse linear equations which are either difficult to solve on the available computer storage or become very expensive to invert. So, if more and more storage becomes available, it is beyond doubt that matrix size also grows at a faster rate. Therefore it is necessary to develop techniques such that these matrices are efficiently handled. Sparse matrices occur in many application areas, for example numerical solution of differential equations, structural analysis, network theory, communication systems, power distribution systems, and large-scale space systems.

The National Aeronautical Laboratory (NAL), Bangalore, has developed a new method to handle large random or banded sparse matrices in symmetric or non-symmetric form. Studies carried out by this method have shown considerable time savings, thereby bringing down the net cost of the solution. The method stores and operates the matrices in fully compressed form consisting of two storage segments, one for the addressing scheme and the other for the matrix elements.

The sparse matrix is compiled in these two storage segments and the solution is obtained via compact elimination algorithm. The software for this is available in the laboratory. □

NML develops clay-graphite stopper heads

In a project sponsored by Patna Estate Super Graphite Product Ltd, Titilagarh, the National Metallurgical Laboratory (NML), Jamshedpur, has developed clay-graphite stopper heads using entirely indigenous raw materials. Clay-graphite stopper heads are used for controlling the flow of molten steel through nozzles fitted at the bottom of ladle, and give better performance than fireclay stopper heads under stringent service conditions.

In-plant trials carried out at Tata Iron & Steel Co. Ltd have shown encouraging results. NML has also assisted the sponsor in utilizing the technology.

The NML product has the potential of replacing the currently used, imported product. □

Pelletization of Kudremukh Iron Ores

NML's Investigations

At the instance of Metallurgical & Engineering Consultant (India) Ltd, technical consultant to Kudremukh Iron Ore Company to advise on their proposed pelletization plant, the National Metallurgical Laboratory's field station at Madras carried out detailed investigations to work out conditions for the production of direct reduction/blast furnace quality iron ore pellets. The results of the investigations on the characteristics of the concentrate, pelletization procedure, physical tests on green and hardened pellets, etc., which will form the basis for the design of the proposed plant, were provided to the consultancy organization.

The Kudremukh company, which has a capacity to produce 7.5 million tonnes of iron ore concentrate per annum, has plans to set up a 3 million tonnes per annum pelletization plant. □

CRRI adopts a systems approach to rural roads development

For tackling the problems of development of a rural road network, comprising the aspects of planning, design, construction, quality control, development of appropriate (animal-drawn) equipment and maintenance, the Central Road Research Institute (CRRI), New Delhi, has adopted a systems approach. A notable feature of work which the institute has recently completed is the development of a planning model for optimizing a rural road network. In this model, the *mandi* towns and market centres are considered as concentrated electric charges and the various villages as smaller charges (in proportion to their populations) which are attracted towards the concentrated charges representing the market centres. The force of attraction is taken as the basis for developing the road network and evaluating the traffic demand. Such a model systematizes the planning process and optimally utilizes the road lengths linking various villages by roads with appropriate levels of serviceability. □

'Tender' Coconut Water from Waste Ripe Coconut Water

Ripe coconut water need no longer be wasted now as a result of a simple technique which the Regional Research Laboratory (RRL), Trivandrum, has developed for upgrading and preserving it in bottles. The advantages of bottled coconut water over traditional tender coconut water, consumed largely as a cool drink during summer, are obvious. Tender coconut water, because of its poor keeping quality, can reach only places not far from production centres; bottle-preserved coconut water can have market throughout the country and through all seasons. What is more significant from the economic point of view is that the process is aimed at waste utilization.

Kerala alone, for instance, produces more than four billion coconuts per

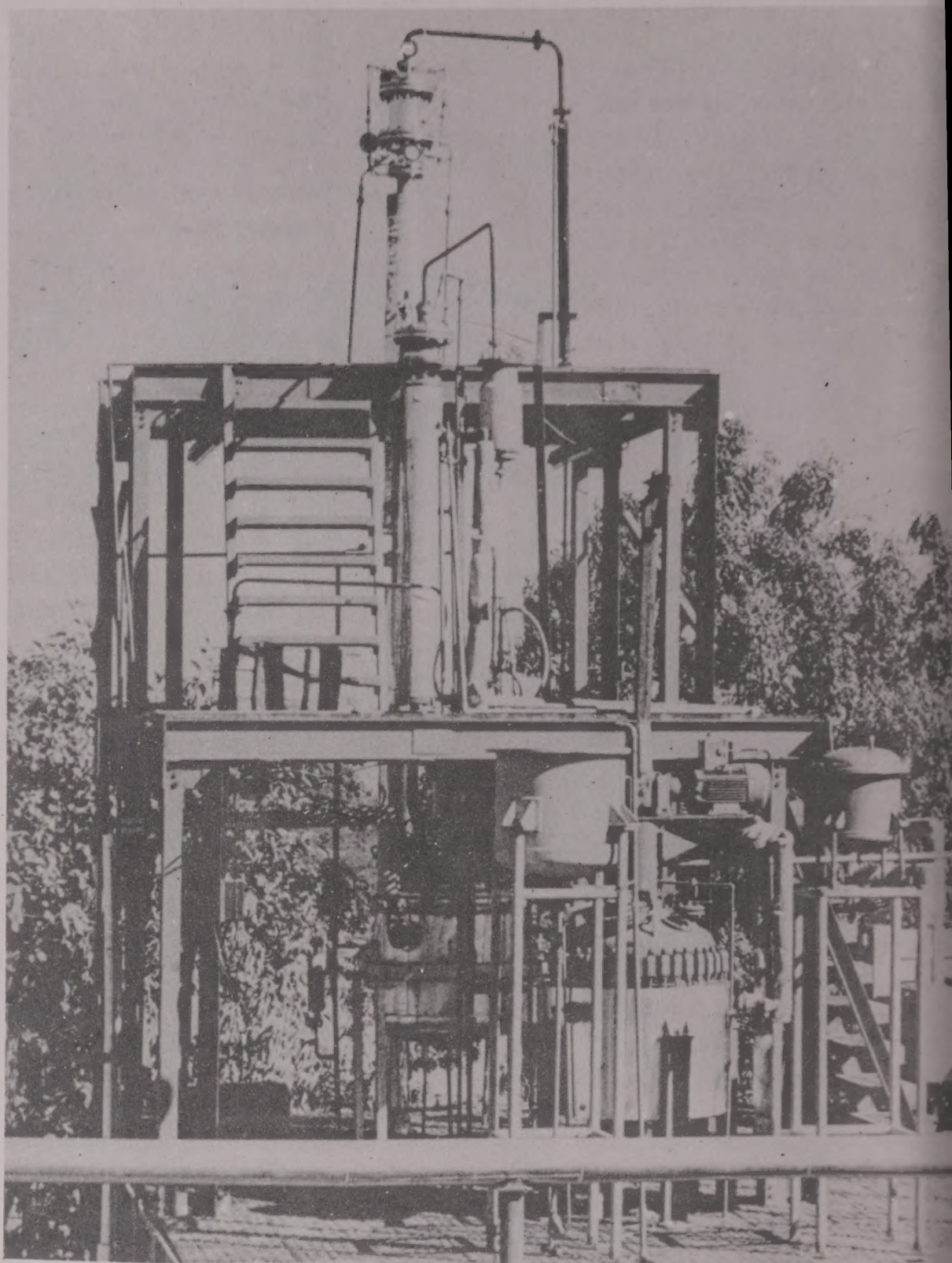
annum of which 50% is used for copra-making. Ripe coconut water available to the tune of 270 million litres from copra-making units in the state is at present wasted. The method of upgrading ripe coconut water to the level of tender one and preserving it in bottles would, when adopted, be an additional income to copra-making units. Manufacturers of desiccated coconut and partially defatted coconut gratings would also benefit. Technology for making defatted coconut gratings is already available to industry, thanks to this regional laboratory's work. Furthermore, the technique for upgrading and preserving ripe coconut water could obviate the need to harvest tender coconut for beverage purposes.

It has been found that bottled coconut water has a long storage life, of more than two months, at ambient temperature. Consumer evaluation studies have also shown that the product is fully acceptable. The process is also technically feasible and economically viable and can be operated by small-scale units near copra-producing areas. Also, the plant and machinery required for commercializing the process are indigenously available. □

Terpineol Plant for Burma

In the design, fabrication, commissioning and eventual exportation to Burma of the integrated pilot plant for the manufacture of the perfumery chemical terpineol [CN 31 (1981), 113], the National Chemical Laboratory (NCL), Pune, and the Mechanical Engineering Research and Development Organisation, Pune, collaborated with each other. The plant, based on NCL technology, is designed to produce 10 kg/batch of terpineol from turpentine oil and was fabricated at a cost of Rs 10 lakh.

Shri S. Gopichand and Shri R.G. Kelkar of NCL, were deputed, besides Shri A.K. Dey of MERADO, to Burma to assist the Central Research Organisation, Rangoon, in the commissioning of the pilot plant.



Terpineol pilot plant exported to Burma under ITEC programme

The project was executed on behalf of the National Research Development Corporation of India under the Indian Technical and Economic Cooperation programme. □

RRL-Jammu transfers diosgenin-progesterone technology to Burma

Scientists of the Regional Research Laboratory (RRL), Jammu, have recently commissioned a diosgenin-progesterone plant at Hmaw Bi near Rangoon, Burma. The project was

handled on a turn-key basis by the laboratory at the instance of the National Research Development Corporation of India under the Indian Technical and Economic Cooperation programme.

The RRL-Jammu scientists imparted on-the-plant training to Burmese scientists in production technology and plant operation. The plant consists of units for pre-treatment, hydrolysis, extraction, isolation and purification of diosgenin, conforming to Indian, British and TEMA standards and

for processing various
in-bearing raw materials. □

NCL develops process for key intermediate for fungicide Tridemorph

Process for the preparation of N-diisopropanolamine (TDDIPA) from tridecylamine and propylene oxide has been successfully developed by the National Chemical Laboratory (NCL), Pune, on behalf of F&F (India) Ltd, Bombay, on a turnkey basis. Developed within the stipulated period, the process was successfully demonstrated to the representatives of the firm in August 1981. TDDIPA is a key intermediate in the manufacture of Tridemorph (Calixin), a fungicide with both protective and eradicant properties and used mainly in control of powdery mildew in cereals. The product developed on the basis of NCL know-how compares well with the imported fungicide.

F&F (India) Ltd have been issued a licence to produce 50 tonnes per annum of Tridemorph. This fungicide is not yet manufactured in the country. □

New Perfumery Compounds from (+)-Car-3-ene

Indian turpentine oil ex-*Pinus roxburghii* Sarg. syn. *longifolia* Roxb. contains (+)-car-3-ene (3, 7, 7-trimethylbicyclo[4.1.0]hept-3-ene) as its major constituent (55-65%). If the entire turpentine available in India (about 9,000 tonnes) could be fractionated into its various constituents, (+)-car-3-ene itself would be available to the tune of 5,700 tonnes. Hitherto, it has been used merely as a solvent for varnishes, polishes and the like. In view of extending the uses of the turpentine oil's major constituent, Shri Narain Misra of the Chemistry Division of Central Institute of Medicinal & Aromatic Chemistry (CIMAP), Lucknow, has applied for patent on certain chemical reactions and transformations for synthesizing numerous compounds of value in perfumery and

food flavour industries from (+)-car-3-ene.

The recent developments on the electrophilic substitution of acyl groups in (+)-car-3-ene molecule by Friedel Crafts reaction have opened up a new scope for preparing new synthetic aroma compounds possessing different odours of use in perfumery and food flavour industries. The syntheses of 4-acyl-3,7,7-trimethylbicyclo[4.1.0]hept-3-ene and its position isomers have been accomplished by the reaction of acid anhydrides on (+)-car-3-ene in the presence of a Lewis acid (ZnCl_2) as catalyst in an yield of 45-60%. Position isomers were isolated by repeated column chromatography and preparative TLC, and the structures were elucidated by spectral studies.

The sodium borohydride reduction of 4-acyl-3, 7, 7-trimethylbicyclo[4.1.0]hept-3-ene and its position isomers has been achieved to prepare, in good yields, alcoholic derivatives possessing different odours of interest to perfumers. The reduced product, 4-(1-hydroxyalkyl)-3, 7, 7-trimethylbicyclo[4.1.0]hept-3-ene, and its position isomers were further esterified with various acid chlorides to prepare 4-(1-acyloxyalkyl) derivatives, some of which have a very good note resembling natural food flavours.

The halogenation-dehydrohalogenation reaction has been applied on the ethylene bond of (+)-car-3-ene molecule, which results in the breaking of strained cyclopropane ring and thus reorienting the molecule into the benzene skeleton. By this reaction the products *p*- and *m*-cymene were obtained in a very good yield (70%). The same reaction has been applied on the Friedel Crafts products and their derivatives (prepared as described above) for the synthesis of several compounds possessing odours reminiscent of dill, fennel, cedarwood oil, etc. The different compounds formed in the reaction product were isolated by chromatographic methods and their structures established by spectral studies. During this reaction the

cleavage of cyclopropane ring of substituted carene molecules yielded some compounds possessing novel structures.

A simple and cheap method for the synthesis of odour compounds from (+)-car-3-ene has been developed by the addition of primary alcohols (moisture-free) in the presence of BF_3 -etherate as catalyst. The addition was in accordance with the Markownikoff's rule and the products, many of them in good yield, possessed good notes of dill, vetiver, rose, etc. oils. The compounds have been purified and structures established by spectral studies.

Shri Misra, who carried out the work under the guidance of Dr M.C. Nigam, head of CIMAP's Chemistry Division, was awarded Ph.D. degree by the Avadh University, Faizabad, for his thesis based on the above studies. □

PROGRESS REPORTS

RRL-Jammu

Annual Report: 1980

The annual report of the Regional Research Laboratory (RRL), Jammu, for 1980, published recently, highlights its progress in chemical engineering and design. Fabrication of two commercial plants for the manufacture of diosgenin on turn-key basis, fabrication and commissioning of an electrical kiln as well as a coal-fired drier for drying hops, and of a walnut-washing machine are among the important pieces of work. The design and fabrication of one of the diosgenin plants (500 kg per batch of raw material) was done on behalf of the National Research Development Corporation of India for installation at the Central Research Organisation, Rangoon, in pursuance of the Indian Technical and Economic Cooperation programme to help Burma. The other diosgenin plant, of 750 kg per batch capacity, was designed and fabricated for the Cinchona Department of Tamil Nadu government. The hops drier—an electrically operated kiln with a capacity to dry 2000 kg of fresh hops per day—was designed, fabricated and commis-

sioned at Sumbal (near Srinagar) for the Horticulture Department of the Jammu & Kashmir government. The coal-fired hops drier, of 1500 kg of fruit per day capacity, was commissioned at its branch laboratory at Srinagar. The in-shell walnut-bleaching unit, of 250 kg wallnuts per batch capacity, designed and commissioned in the laboratory itself is based on a technique which it has developed and is superior to the traditional processes; the product, being clear and at the same time attractive, has export potential.

Following successful, and pioneering, work on hydrogenation and disproportionation of rosin, using catalysts which it has developed, the laboratory provided project reports to the sponsor for setting up 1 tonne and 2 tonnes per batch capacity plants for production respectively of hydrogenated rosin and disproportionated rosin.

The process know-how developed by this laboratory for the manufacture of gibberellic acid (GA_3) was demonstrated to the representative of a firm to whom the process was eventually transferred. Yields of GA_3 ranged from 450 to 524 mg/litre during demonstration. Under its drug development programme, the laboratory completed clinical trials on vasicine as an oxytocic and abortifacient. Clinical trials for its intra-amniotic use as an abortifacient in mid-trimester pregnancy showed it to be highly effective with complete abortion resulting in 93% cases. One of the synthetic derivatives of vasicine was found three times as potent as vasicine in both oxytocic and bronchodilatory activities. Among its esters, vasicine stearate possessed maximum bio-half-life, and could prove to be a more effective abortifacient. The anti-haemorrhagic activity of vasicine and vasicinone was also being studied. A monographic book on its work on vasicine was brought out.

Pharmacological investigations on *Allium cepa* (var. Red Multiplier) have shown that the ethyl acetate fraction of its extract, which contained quercetin, possesses anti-asthmatic properties.

The laboratory has adduced scientific evidence for use of *Piper longum* and *P. nigrum* to enhance the bioavailability of drugs with which these are compounded in Ayurvedic preparations.

Clocimum, the oil of which can substitute clove oil, developed by an intensive hybridization of different races of *Ocimum gratissimum* has been brought under commercial cultivation (3.2 ha) in Jammu. Hybrid seed of *Clocimum*, for which there is great demand, is being supplied by the laboratory, on payment, to parties, who are also provided know-how for raising the crop. A new variety of *Cymbopogon* named Jamrosa, whose oil is rich in geraniol and whose yield twice that of palmarosa, was being released to cultivators. A new variety of hops named Comet, from USA, and introduced in Kashmir Valley in 1975, has been found after prolonged trials to be superior to other varieties; it was released to farmers during the year.

The laboratory continued its work on characterization of clays from different regions of the state. The use of clays from Kathua district in brick manufacture and as a decolorizer in oil industry was under study. Various ceramic body compositions were standardized using clays from Purmandal area. Ceramic stains, fritted as well as raw matching glazes, for these ceramic bodies were developed and successfully utilized. To utilize waste plaster moulds the laboratory has worked out a process on a pilot plant scale*; the technology would be of considerable utility to medium-scale ceramic units, which now discard ceramic moulds after some 90 casts are taken. The technology for making dental-grade plaster, released to industry already, was further improved upon. Following the successful development of a process for boric acid, a turn-key project for its manufacture was taken up. Laboratory-scale processes

*Another CSIR constituent—Central Glass & Ceramic Research Institute—has also developed a semi-commercial scale process for regenerating plaster of Paris from waste plaster moulds.

for a number of boron-based chemicals were developed.

The laboratory brought out technical reports on its successful projects relating to (i) roofing sheets from pine needles; (ii) technical know-how for straw/mill board (100 tonnes/day); (iii) vanillin from *Clo* oil, and (iv) improved technology for bleaching in-shell wallnuts. Sixty research papers were published.

Indian Journal of Pure & Applied Physics

SPECIAL ISSUE ON CRYSTALLOGRAPHY

The September 1981 issue (Vol. No.9) of *Indian Journal of Pure & Applied Physics* has been brought out as a special number devoted to crystallography, on the occasion of the sixtieth birthday of Dr Ajit Ram Vaidya, Director, National Physical Laboratory, New Delhi. This number (188 pages) contains specially invited articles—research and review papers contributed by outstanding crystallographers from India and abroad. The articles, 20 in all, deal with synthetic crystal growth, characterization of materials, and structure of matter. Some of the papers report the latest results obtained by using widely different techniques like electron diffraction, x-ray diffraction and neutron diffraction while others deal with various aspects of crystallographic teaching and instrumentation.

Articles contributed by overseas scientists are: (1) Structural properties of crystals under dielectric load (Thoma, Physikalisch Technische Bundesanstalt (PTB), FRG); (2) Crystal engineering in electronic materials (Bardsley, Royal Signals & Radar Establishment, UK); (3) Live X-ray topography (Jum-Ichi Chikawa, National Broadcasting Science Research Laboratories, Japan); (4) Electron diffraction structure analysis: Successes, results and prospects of the development (Z.G. Pinsker & R.M. Imants, Academy of Sciences of the USSR); (5) Crystallography—The continuing

ion of the subject (Alan L. Birkbeck College, University on, UK).

ssue was released by Prof. S. asan, CSIR Vice President, at a held at NPL, New Delhi, on 21 per in celebration of Dr Verma's thday.

es of the special issue (Rs 12 per re obtainable from the Sales & ution Officer, Publications & ation Directorate (CSIR), e Road, New Delhi 110012. □

Indian Journal of Technology

SPECIAL NUMBER ON
FLUID MECHANICS

tober 1981 number (Vol. 19, No. *Indian Journal of Technology* thirteen of the papers presented First Asian Congress of Fluid nics held at Indian Institute of e, Bangalore, during 8-13 ber 1980. The conference —some presented in the main and some in the poster s—received for publication were ndently evaluated by reviewers ly those recommended by them cepted for inclusion.

ies of the special number (Rs 9 per are obtainable from the Sales & ution Officer, Publications & ation Directorate (CSIR), New 110012. □

RAMURAL RESEARCH

Ultrasonic Velocities in Solids Liquid Helium Temperatures

ng as a CSIR research fellow at partment of Physics of the Indian te of Science, Bangalore, Shri adaki has determined ultrasonic ies in crystalline galena and hous Se-P samples at low ratures down to liquid helium rature.

ath-type cryostat, using about 3 f liquid helium for an experiment, esigned and fabricated for the se. A special mechanism for ng new bonding liquid materials r temperatures is incorporated in

the design. Facilities for using the same cryostat for high-temperature work (150°C) are also provided.

Measurements of ultrasonic velocities on crystalline galena and amorphous Se-P samples were successfully completed down to 4.2 K. It was necessary to use different bonding materials in different temperature ranges. The elastic constants of galena at 5 K were $C_{11} = 14.9_0$, $C_{12} = 3.5_1$, $C_{44} = 2.9_2$ ($\times 10^{10}$ N/m²).

The longitudinal and transverse velocities in glassy $\text{Se}_{80}\text{P}_{20}$ at room temperature were $V_l = 1920$ m/s and $V_t = 1035$ m/s respectively, and at 4.2 K were $V_l = 2106$ m/s and $V_t = 1126$ m/s. Down to the temperature investigated this chalcogenide system exhibited negative temperature coefficient of velocity, confirming that the positive temperature coefficient of velocity is characteristic of tetrahedrally bonded material.

The ultrasonic velocities were also measured near the glass transition temperature of glassy Se-P and Se-Ge samples. The values showed a drastic decrease near glass transition temperature, reflecting the nature of relaxation process taking place near this temperature. The elastic properties of Se-P glasses were also studied as a function of composition.

A novel technique of determining the compressibility of materials available as powder particles was developed, and successful measurements on a few metallic powders were carried out. □

Improved *Aspergillus* Strain for Citric Acid Production

At the Bose Institute, Calcutta, a strain of *Aspergillus niger* has been isolated from several soil isolates, which produced 2.6% citric acid in a medium containing 14% sucrose. The researcher was a CSIR postdoctoral fellow, Dr (Smt) Ponty Roy. She has further improved the potency of the strain by subjecting it to multistep mutagenic treatment with ethyleneimine, nitrous acid, and saccharine. At each step of treatment the yield increased considerably and the

best strain was a saccharin mutant, ENS 221, which produced 4.6% citric acid vs 2.6% yield from the wild parent.

Seed cultures were grown in various synthetic and semi-synthetic media, and spore crops derived from them were used to inoculate the fermentation medium. Citric acid production was found to be highly affected by the composition of the seed culture medium; corn steep agar was found to be the best medium to provide inoculum for maximum citric acid production. □

PERSONNEL NEWS

Prof. M. Santappa

Prof. M. Santappa, Director, Central Leather Research Institute (CLRI), Madras, has been relieved of his post effective 24 September 1981 to enable him take up Vice-Chancellorship of Madras University. □

Appointments|Promotions

At the National Environmental Engineering Research Institute (NEERI), Nagpur, and its zonal laboratories, the following have been promoted from Scientist B to C position: Dr T. Swaminathan (17 July 1981); and Shri V. Subbiah (Hyderabad zonal laboratory) (23 July 1981).

Promoted on assessment, also at NEERI and zonal laboratories, are: from Scientist B to C—P. Nema (Ahmedabad zonal laboratory) (27 July 1980); Dr T. Chakrabarti (16 Oct. 1980), Shri M.V. Nanoti (18 Feb. 1981), Dr S.P. Pande (18 Feb. 1981); from Library Officer B to Documentation Officer C—Shri S.K. Kesarwani (23 Oct. 1979); from Publication Officer B to Production Officer C—Shri C.M. Freitas (6 May 1981); from Scientist A to Scientist B—Smt. A.S. Gadkari (24 Feb. 1981); from Senior Scientific Assistant to Scientist A—Shri S.I. Elyas (Hyderabad zonal laboratory) (4 Jan. 1979); Shri V.P. Sharma (Kanpur zonal laboratory) (8 March 1979); Smt. M.V. Vaidya (7 Dec. 1980); Smt. R.A. Thakre (2 April 1981); Shri W.G. Nawlakhe (15 April 1981); Dr G.H. Pandya (28 April 1980), who had been

promoted effective 17 Dec. 1980 by selection; Shri S.V. Waghmare (21 May 1981); and from Senior Library Assistant to Library Officer A—Smt. S.N. Sinnarkar (9 March 1981). □

Honours & Awards

Shri I.N. Sengupta of the Indian Institute of Chemical Biology, Calcutta, has been nominated a member of the FID (Federation Internationale de Documentation) Committee on Informatics. □

Prof. Pradeep K. Rohatgi, Director, Regional Research Laboratory, Bhopal, has been appointed a member of the advisory committee of 'Technological Forecasting and Social Change', a journal of the American Elsevier Publishing Co. Inc., New York. □

PATENTS INFORMATION

Indian Pat. 14/Del/78

Electrochemical process for preparation of 2-amino-1,3-xylene from 2-nitro-1,3-xylene

H.V. Udupa, P.N. Anatharaman & M. Neol
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This process relates to the improvement in the electrolytic reduction of 2-nitro-1,3-xylene to 2-amino-1,3-xylene. The latter finds application as an intermediate in the production of azo dyes, aviation gasoline additives to raise the octane rating, rubber accelerators, wood preservatives, wetting agents for textiles, anti-oxidants for paint pigments, frothing agents in ore dressing, and oral contraceptives. The process has advantages over that in which reduction is carried out with iron and hydrochloric acid. Since aniline (or its derivative) has a tendency to complex with iron, it may not be possible to isolate the product quantitatively with high purity in the conventional process. Moreover, disposal of iron oxide sludge is a problem.

The improved electrochemical process consists in reducing a suspension of 2-nitro-1,3-xylene in a catholyte of sulphuric acid of up to 20% (v/v) concentration with 0-1% copper sul-

phate. A stationary or rotating cathode of copper, a temperature of 30-90°C, preferably 50-60°C, and a current density of up to 25 A/dm², preferably 5 A/dm², are employed. The anolyte is sulphuric acid solution of up to 40%, preferably 20% (v/v). Ceramic or blue asbestos, preferably the former, is used as diaphragm. Lead in pure form or in an alloy form, either as lead-antimony or lead-silver, is used as the anode. Addition agents like titanous sulphate or titanous sulphate of concentration equivalent to 10 g TiO₂ in one litre of catholyte are used. Cetyltrimethylammonium bromide (CTAB) is also used as addition agent in a concentration of 0.01% (w/v) of the catholyte. Copper sulphate up to 0.1% (w/v) of catholyte is added to the catholyte and electrolysis is carried out prior to addition of 2-nitro-1,3-xylene so that copper gets deposited on the cathode and hence increases the surface area.

The salient features of the improved process are:

1. Reduction proceeds smoothly with high efficiency.
2. No product other than 2-amino-1,3-xylene is formed during the course of reduction.
3. Use of addition agents like copper sulphate, titanous sulphate and CTAB makes the electrolytic reduction simpler: reduction can be carried out even under stationary electrodes.
4. The isolated product is extremely pure (99%). □

PATENTS FILED

177/Del/81: Film burner, P.N. Bhambi, H.K. Madan, K.N. Dobhal, & V.L. Gudzyuk (UNDP expert, USSR)—IIP, Dehra Dun.

176/Del/81: Improved liquid fuel-fired industrial burners, U.K. Jaiswal, K.S. Kambo, P.N. Bhambi, & V.L. Gudzyuk (UNDP expert, USSR)—IIP, Dehra Dun.

474/Del/78: A power sprayer, D.C. Parashar, Narender Kumar, V.K. Bahl, & J.R. Anand—NPL, New Delhi.

223/Del/81: A closed-circuit hydraulic prop for support of mine with an improved relief valve mechanism, S.A.K. Datta, M.N. Tar, P. Roy, & S. Bagchi—CI Dhanbad.

511/Del/81: A combination protection device for over-current and leakage of electrical wiring system in civil structures and electrical equipment, F. Husain & S.S. Wadhwa—C Roorkee.

670/Del/80: A process for blanching of hot-dipped aluminium coatings on steel for solar application, B.A. Shenoi, S. John, Shanmugham, K.N. Srinivasan, Selvem & V. Balasubramani—CECRI, Karaikudi.

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Qualifications: (i) High academic qualifications in any branch of science/technology or information system; (ii) about 15 years' experience of responsible capacity in the above or allied fields; and (iii) good knowledge of modern methods of information acquisition, storage and retrieval.

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